

## EXECUTIVE SUMMARY

Thank you for your continued hard work sampling **Great Pond** this year! Your monitoring group sampled the deep spot **four** times this year and has done so for many years. As you know, conducting multiple sampling events each year enables DES to more accurately detect water quality changes. Keep up the great work!

As part of the Environmental Protection Agency's (EPA) National Lake Assessment (NLA) initiative and the Probabilistic Lake Assessment (PLA), DES biologists performed a comprehensive lake assessment on **Great Pond** in **June** during **2009**. The NLA and PLA serve to assess the Nation's lake and determine the percentage of our Nation's lakes that are in good, fair or poor condition. Lakes were randomly selected based on a statistical survey representing the population of lakes in their ecological region, but had to be at least one meter deep and over ten acres in size. Lakes were assessed using standard protocols, and the following parameters were measured: temperature, dissolved oxygen, nutrients, chlorophyll-a, water clarity, turbidity, color, zooplankton and phytoplankton, bacteria, macroinvertebrates, habitat condition, and sediment cores. Some data from this assessment has been included in your annual report and added to the historical database for your pond. The lake's data will help to determine the regional and national condition of lakes. Those volunteer monitoring groups with historical data can compare the condition of their lakes on a statewide, regional or national level. Data from the National Lake Assessment will be compiled, entered into a national database, analyzed, and a draft report will be made available for public review. For more information about EPA's NLA please visit [www.epa.gov/owow/lakes/lakessurvey](http://www.epa.gov/owow/lakes/lakessurvey).

Volunteers from your pond participated in the Lake Host™ Program this year. The Lake Host™ Program is funded through DES and Federal grants. The program was developed in 2002 by NH LAKES and NHDES to educate and prevent boaters from spreading exotic aquatic plants to lakes/ponds in New Hampshire. Since then, the number of participating lakes/ponds and volunteers has doubled, the number of boats inspected has tripled, and the number of "saves" (exotic plants discovered) has increased from four in 2002 to a total of 297 in 2009. The program is invaluable in educating boaters and protecting NH's waterbodies from exotic aquatic plant infestations, thereby preventing recreational hazards, property value decline, aquatic ecosystem decline, aesthetic issues, and saving costly remediation efforts. Lake Host™ staff discovered the following aquatic vegetation entering or leaving your pond in 2009:

Bladderwort (native)  
Bur-reed (native)

Great work! We encourage volunteers to continue participating in the Lake Host™ Program to protect the future of your pond.



# OBSERVATIONS & RECOMMENDATIONS

## DEEP SPOT

### ➤ Chlorophyll-a

Chlorophyll-a, a pigment found in plants, is an indicator of algal or cyanobacteria abundance. Algae are typically microscopic plants that are naturally found in the lake ecosystem. The measurement of chlorophyll-a in the water gives biologists an estimation of the algal concentration or lake productivity. Table 14 in Appendix A lists the current year chlorophyll-a data.

Figure 1 depicts the historical and current year chlorophyll-a concentration in the water column.

**The median summer chlorophyll-a concentration for New Hampshire's lakes and ponds is 4.58 mg/m<sup>3</sup>.**

### NORTH STATION

The current year data (the top graph) show that the chlorophyll-a concentration **decreased greatly** from **May** to **June**, and then **increased** from **June** to **August**.

Please note that the **6/1/2009** chlorophyll-a concentration was used to represent the May chlorophyll-a concentration.

The historical data (the bottom graph) show that the **2009** chlorophyll-a mean is **less than** the state and similar lake medians. For more information on the similar lake median, refer to Appendix D.

Overall, visual inspection of the historical data trend line (the bottom graph) shows a **relatively stable** in-lake chlorophyll-a trend since monitoring began. Specifically the mean chlorophyll concentration has **remained approximately the same** since **1995**.

### SOUTH STATION

The current year data (the top graph) show that the chlorophyll-a concentration **decreased** from **May** to **June**, **increased slightly** from **June** to **July**, and then **decreased** from **July** to **August**.

Please note that the **6/1/2009** chlorophyll-a concentration was used to represent the May chlorophyll-a concentration.

The historical data (the bottom graph) show that the **2009** chlorophyll-a mean is **less than** the state and similar lake medians. For more information on the similar lake median, refer to Appendix D.

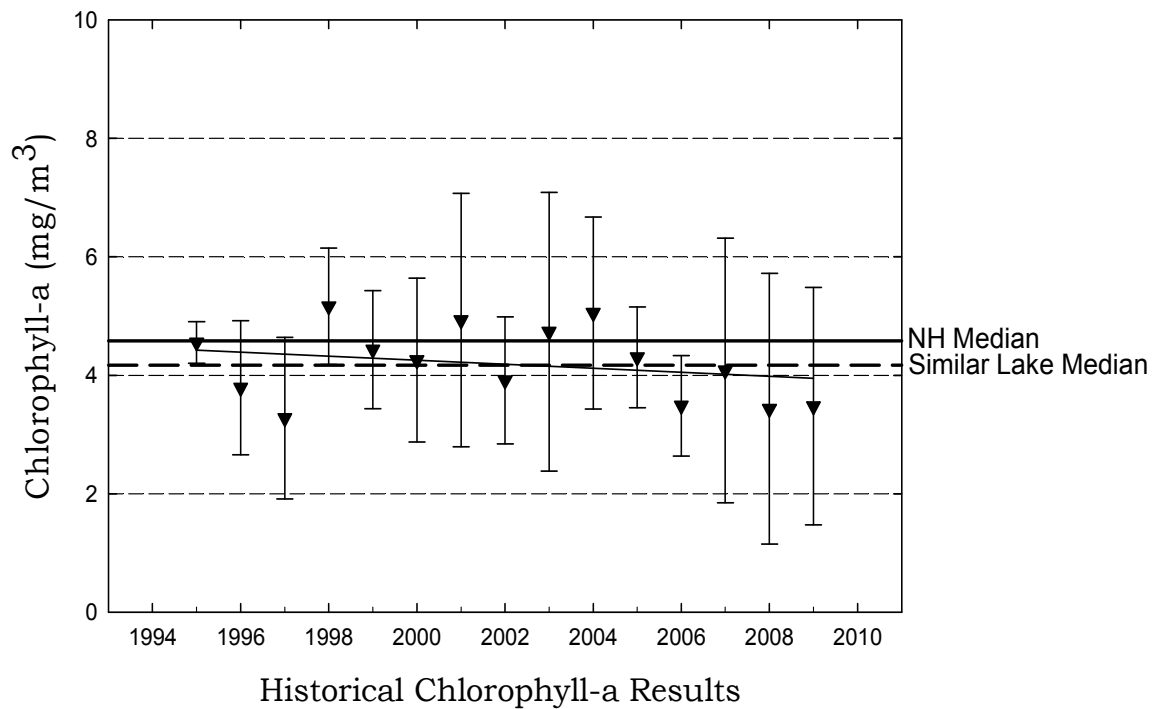
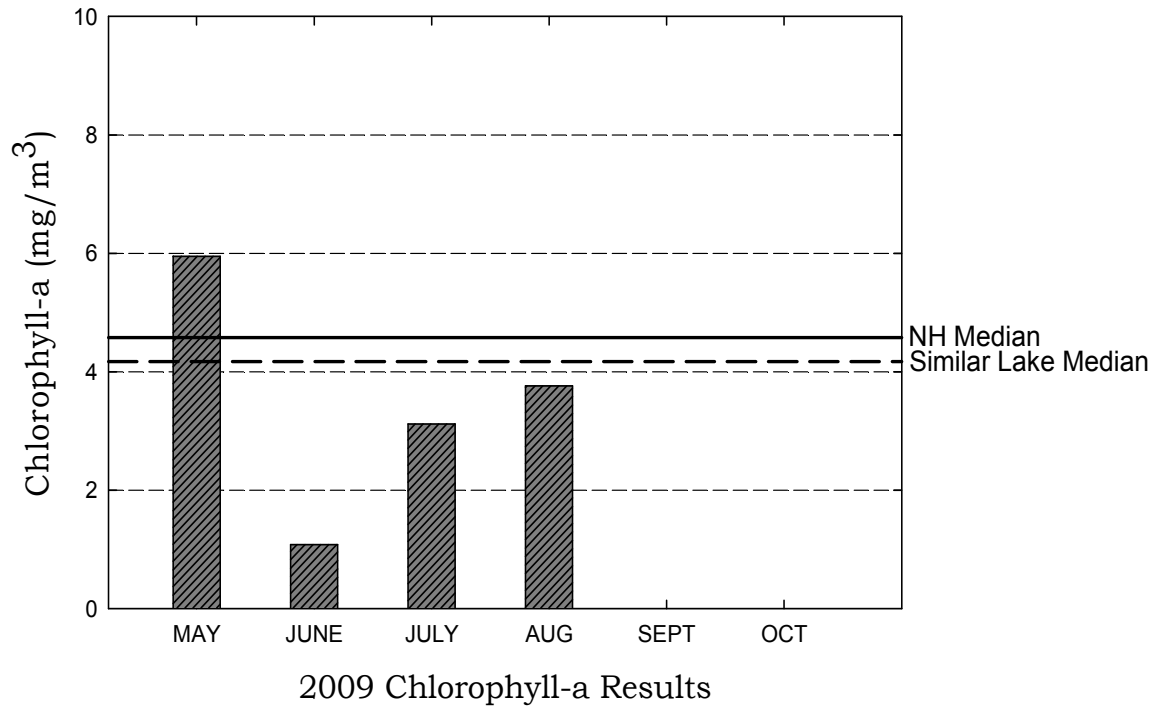
Overall, visual inspection of the historical data trend line (the bottom graph) shows an **increasing** in-lake chlorophyll-a trend since monitoring began. Specifically the mean chlorophyll concentration has **worsened** since **1991**.

While algae are naturally present in all waterbodies, an excessive or increasing amount of any type is not welcomed. Phosphorus is the nutrient that algae typically depend upon for growth in New Hampshire lakes and ponds. Algal concentrations increase as nonpoint sources of phosphorus from the watershed increase, or as in-lake phosphorus sources increase. Increased Chlorophyll-a concentrations can also affect water clarity, causing Secchi-disk transparency to decrease (worsen) and turbidity to increase (worsen).

Therefore, it is extremely important for volunteer monitors to continually educate all watershed residents about management practices that can be implemented to minimize phosphorus loading to surface waters.

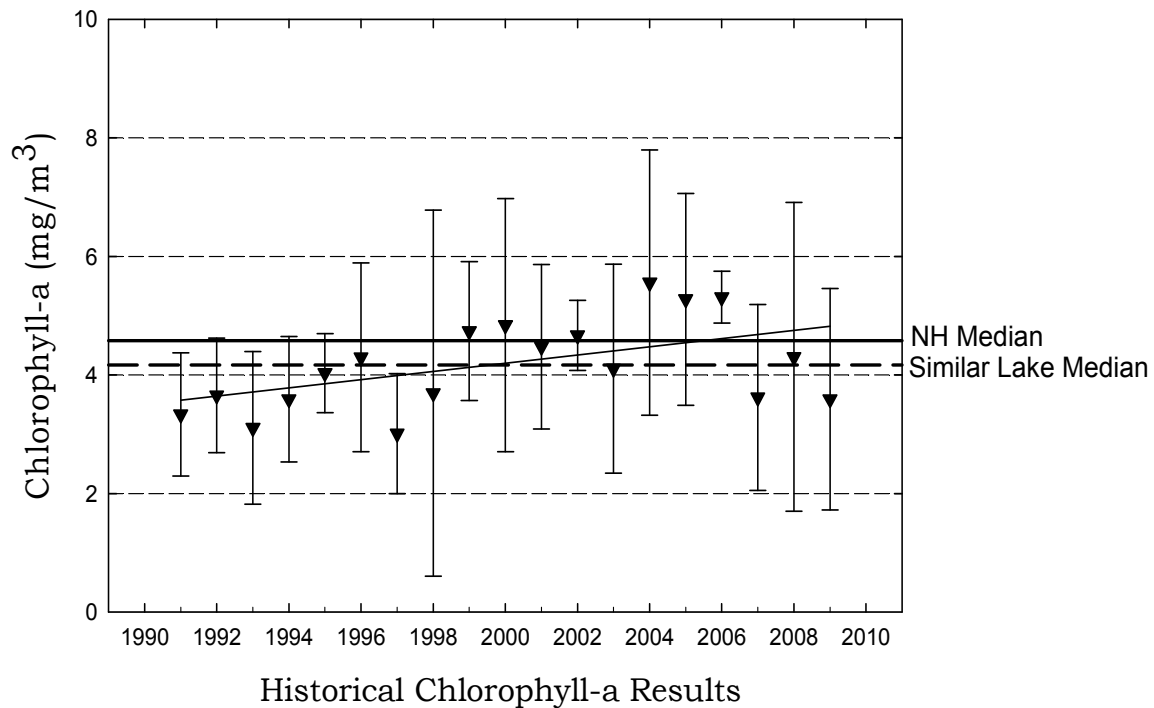
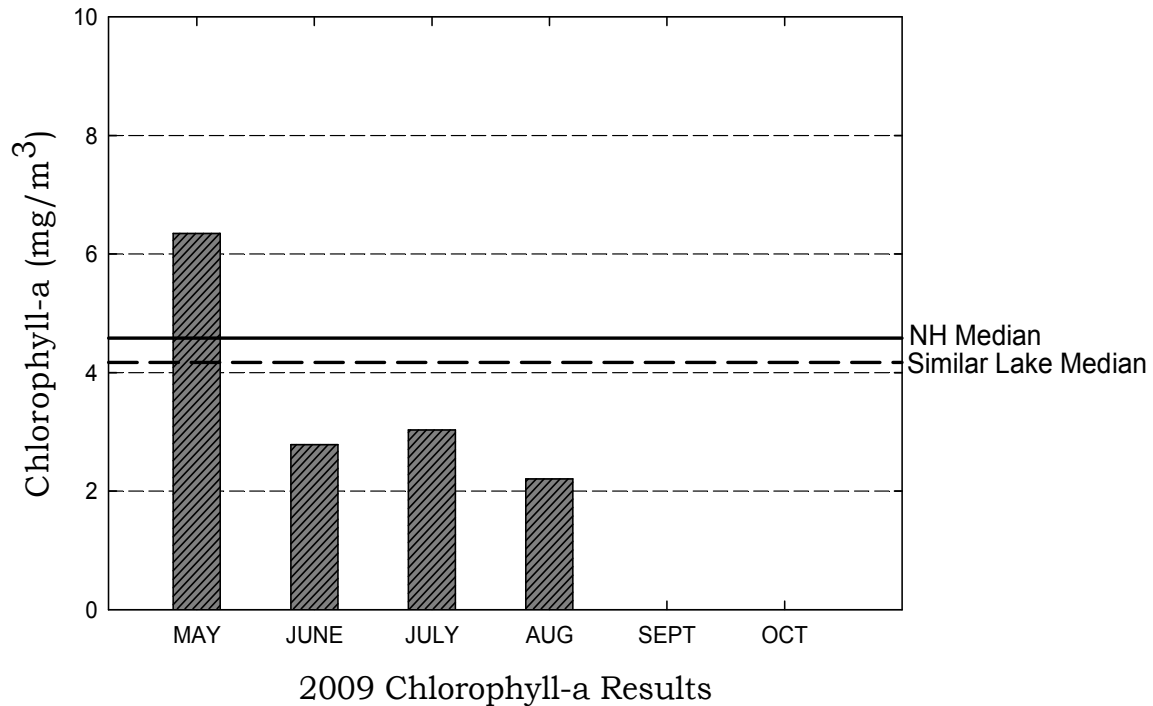
## Great Pond, North Stn., Kingston

**Figure 1.** Monthly and Historical Chlorophyll-a Results



## Great Pond, South Stn., Kingston

**Figure 1.** Monthly and Historical Chlorophyll-a Results



### ➤ **Phytoplankton and Cyanobacteria**

Table 1 lists the phytoplankton (algae) and/or cyanobacteria observed in the pond in **2009**. Specifically, this table lists the three most dominant phytoplankton and/or cyanobacteria observed and their relative dominance in the sample.

**Table 1. Dominant Phytoplankton/Cyanobacteria (July 2009)**

<b>Station</b>	<b>Division</b>	<b>Genus</b>	<b>% Dominance</b>
North	Bacillariophyta	Asterionella	59.5
North	Pyrrophyta	Ceratium	16.5
North	Cyanophyta	Microcystis	4.4
South	Bacillariophyta	Asterionella	65.0
South	Pyrrophyta	Ceratium	11.5
South	Bacillariophyta	Tabellaria	7.6

Phytoplankton populations undergo a natural succession during the growing season. Please refer to the “Biological Monitoring Parameters” section of this report for a more detailed explanation regarding seasonal plankton succession. Diatoms and golden-brown algae populations are typical in New Hampshire’s less productive lakes and ponds.

A small amount of the cyanobacterium ***Microcystis*** was observed in the **July** plankton sample. ***This cyanobacteria, if present in large amounts, can be toxic to livestock, wildlife, pets, and humans.*** Please refer to the “Biological Monitoring Parameters” section of this report for a more detailed explanation regarding cyanobacteria.

Also, a cyanobacteria bloom occurred in the pond in **August**. Samples were collected and returned to the DES Limnology Center for analysis. A **beach advisory** was issued on **8/18/2009** notifying the public of the presence of potentially toxic cyanobacteria. The cyanobacteria were identified as ***Anabaena, Oscillatoria and Microcystis***, all potentially toxic cyanobacteria. Samples were collected regularly throughout the advisory period and the advisory was removed on **8/20/2009** after cyanobacteria concentrations decreased to acceptable levels.

Cyanobacteria can reach nuisance levels when phosphorus loading from the watershed to surface waters is increased and favorable environmental conditions occur, such as a period of sunny, warm weather.

The presence of cyanobacteria serves as a reminder of the pond’s delicate balance. Watershed residents should continue to act proactively to reduce nutrient loading to the pond by eliminating fertilizer use on lawns, keeping the pond shoreline natural, re-vegetating cleared areas within the watershed, and

properly maintaining septic systems and roads.

In addition, residents should also observe the pond in September and October during the time of fall turnover (lake mixing) to document any algal blooms that may occur. Cyanobacteria have the ability to regulate their depth in the water column by producing or releasing gas from vesicles. However, occasionally lake mixing can affect their buoyancy and cause them to rise to the surface and bloom. Wind and currents tend to “pile” cyanobacteria into scums that accumulate in one section of the pond. If a fall bloom occurs, please collect a sample in any clean jar or bottle and contact the VLAP Coordinator.

### ➤ **Secchi Disk Transparency**

Volunteer monitors use the Secchi disk, a 20 cm disk with alternating black and white quadrants, to measure how far a person can see into the water. Transparency, a measure of water clarity, can be affected by the amount of algae and sediment in the water, as well as the natural color of the water. Table 14 in Appendix A lists the current year transparency data. **The median summer transparency for New Hampshire’s lakes and ponds is 3.2 meters.**

Figure 2 depicts the historical and current year transparency *with and without* the use of a viewscope.

#### **NORTH STATION**

The current year *non-viewscope* in-lake transparency **increased slightly** from **May to June**, and then **decreased** from **June to August**.

Please note that the **6/1/2009** transparency was used to represent the May transparency.

It is important to note that as the chlorophyll concentration **decreased** from **May to June**, the transparency **increased**, and as the chlorophyll **increased** from **June to August**, the transparency **decreased**. We typically expect this **inverse** relationship in lakes. As the amount of algal cells in the water increases, the depth to which one can see into the water column typically decreases, and vice-versa.

The current year *viewscope* in-lake transparency **decreased** from **May to June increased**, from **June to July**, and then **decreased** from **July to August**.

The transparency measured with the viewscope was generally **greater than** the transparency measured without the viewscope this summer. A comparison of the transparency readings taken with and without the use of a viewscope shows that the viewscope typically increases the depth to which the Secchi disk can be seen into the lake, particularly on sunny and windy days. We recommend that your group measure Secchi disk transparency with and without the viewscope on each sampling event.



It is important to note that viewscope transparency data are not compared to a New Hampshire median or similar lake median. This is because lake transparency with the use of a viewscope has not been historically measured by DES. In the future, the New Hampshire and similar lake medians for viewscope transparency will be calculated and added to the appropriate graphs.

The historical data (the bottom graph) show that the **2009** mean non-viewscope transparency is **less than** the state and similar lake medians. Please refer to Appendix D for more information about the similar lake median.

Visual inspection of the historical data trend line (the bottom graph) shows a **decreasing** trend, meaning that the transparency has **worsened** since monitoring began in **1995**.

### **SOUTH STATION**

The current year **non-viewscope** in-lake transparency **increased slightly** from **May** to **June**, and then **decreased** from **June** to **August**.

Please note that the **6/1/2009** transparency was used to represent the May transparency.

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It is important to note that viewscope transparency data are not compared to a New Hampshire median or similar lake median. This is because lake transparency with the use of a viewscope has not been historically measured by DES. In the future, the New Hampshire and similar lake medians for viewscope transparency will be calculated and added to the appropriate graphs.

The historical data (the bottom graph) show that the **2009** mean non-viewscope transparency is **less than** the state and similar lake medians. Please refer to Appendix D for more information about the similar lake median.

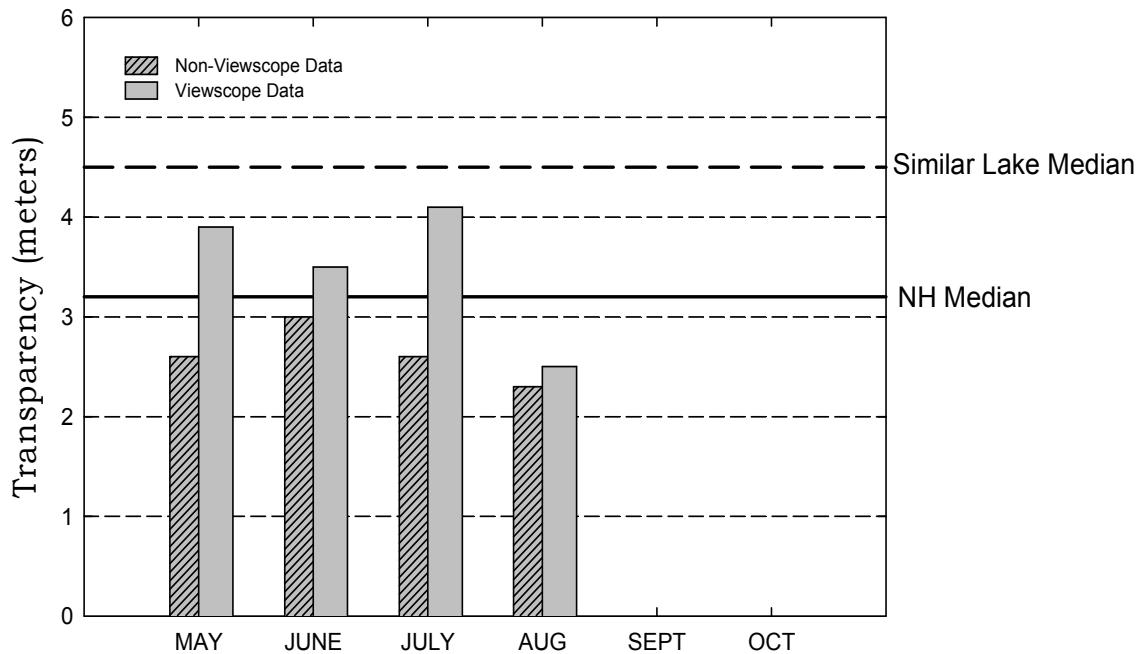
Visual inspection of the historical data trend line (the bottom graph) shows a **decreasing** trend, meaning that the transparency has **worsened** since monitoring began in **1991**.

Typically, high intensity rainfall causes sediment-laden stormwater runoff to flow into surface waters, thus increasing turbidity and decreasing clarity. Efforts should continually be made to stabilize stream banks, pond shorelines, disturbed soils within the watershed, and especially dirt roads located immediately adjacent to the edge of tributaries and the pond. Guides to best management practices that can be implemented to reduce, and possibly even eliminate, nonpoint source pollutants, are available from DES upon request.

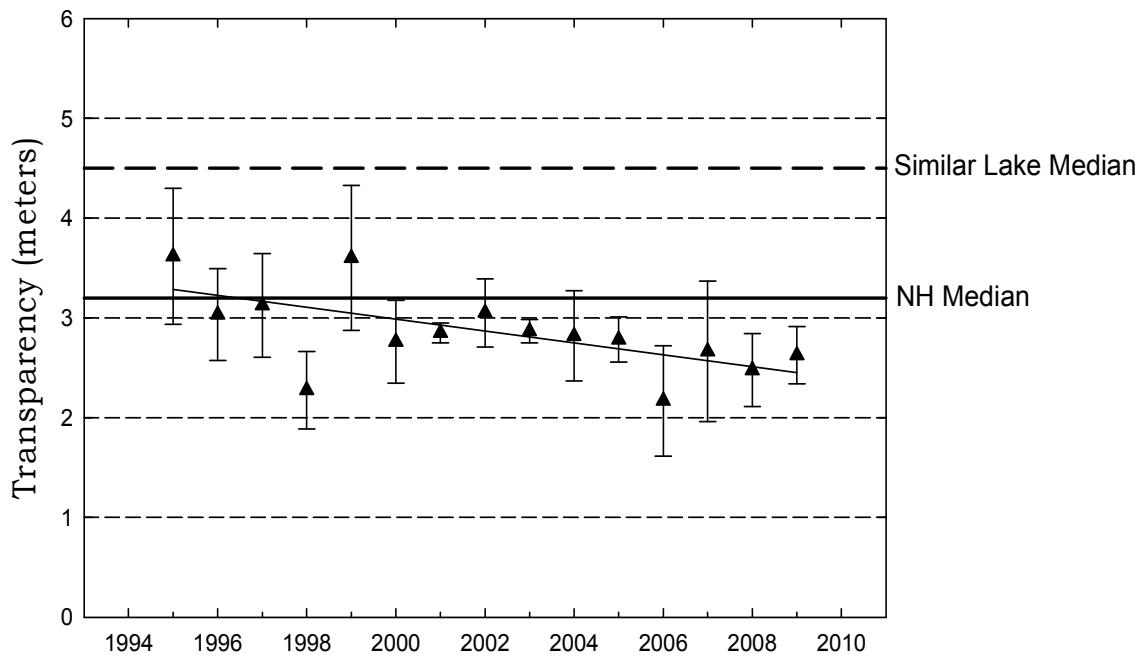
We recommend that your group continue to measure the transparency with and without the use of the viewscope on each sampling event. Ultimately, we would like all monitoring groups to use a viewscope to take Secchi disk readings as the use of the viewscope results in less variability in transparency readings between monitors and sampling events. At some point in the future, when we have sufficient data to determine a statistical relationship between transparency readings collected with and without the use of a viewscope, it may only be necessary to collect transparency readings with the use of a viewscope.

## Great Pond, North Stn., Kingston

**Figure 2.** Monthly and Historical Transparency Results



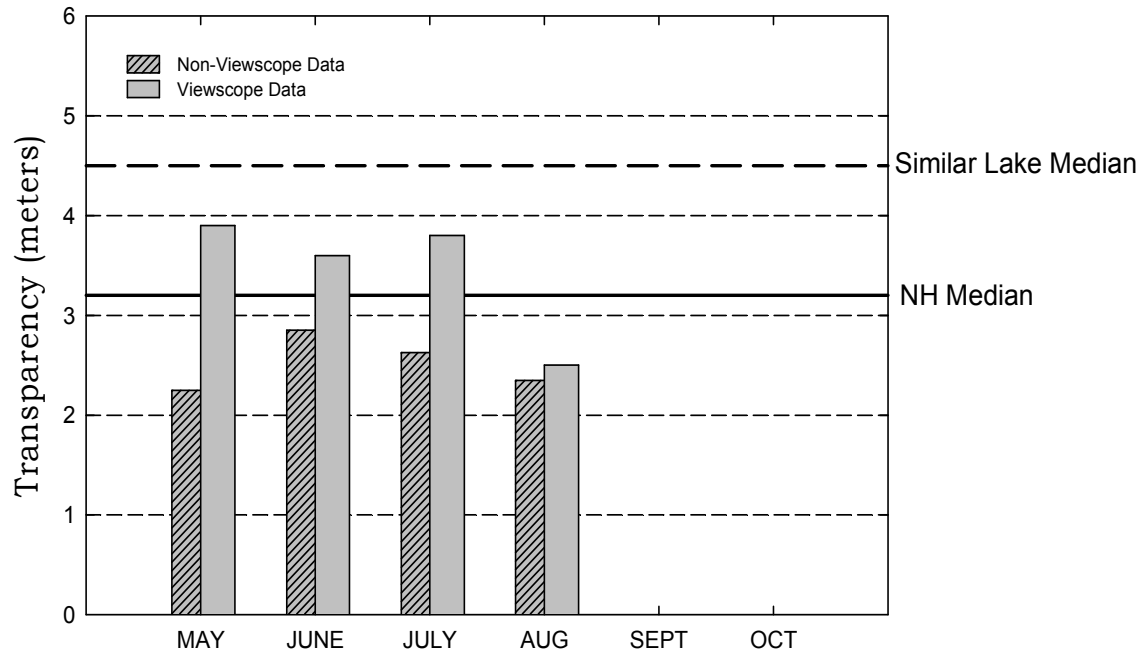
2009 Transparency Viewscope and Non-Viewscope Results



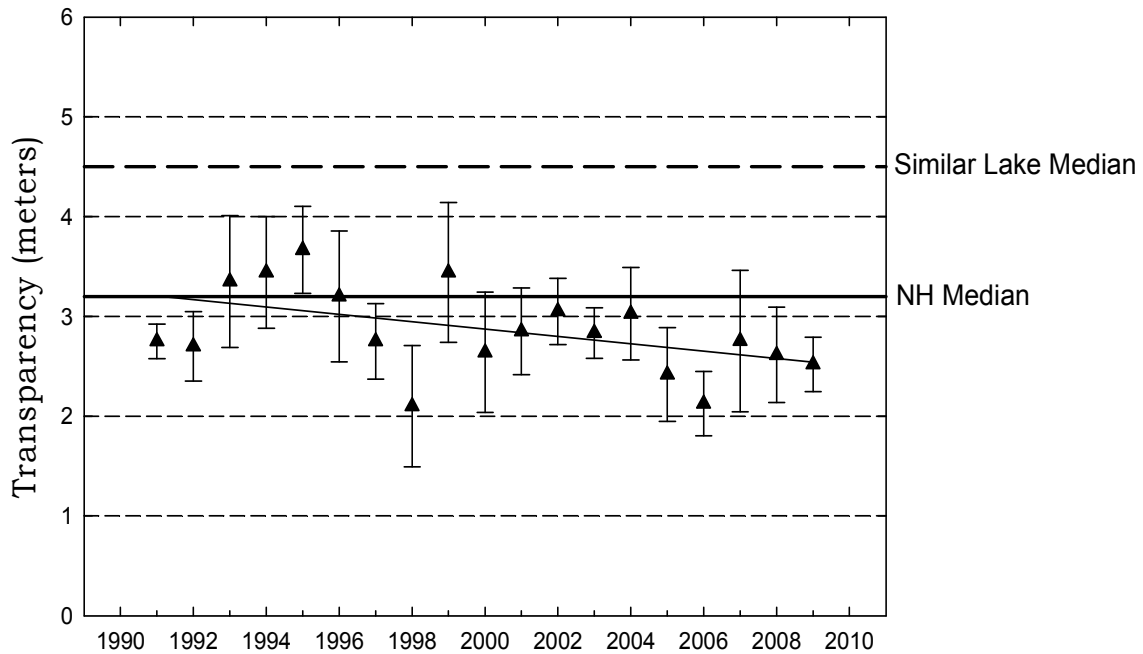
Historical Transparency Non-Viewscope Results

## Great Pond, South Stn., Kingston

**Figure 2.** Monthly and Historical Transparency Results



2009 Transparency Viewscope and Non-Viewscope Results



Historical Transparency Non-Viewscope Results

### ➤ **Total Phosphorus**

Phosphorus is typically the limiting nutrient for vascular plant and algae growth in New Hampshire's lakes and ponds. Excessive phosphorus in a pond can lead to increased plant and algal growth over time. Table 14 in Appendix A lists the current year total phosphorus data for in-lake and tributary stations. **The median summer total phosphorus concentration in the epilimnion (upper layer) of New Hampshire's lakes and ponds is 12 ug/L. The median summer phosphorus concentration in the hypolimnion (lower layer) is 14 ug/L.**

The graphs in Figure 3 depict the historical amount of epilimnetic (upper layer) and hypolimnetic (lower layer) total phosphorus concentrations; the inset graphs depict current year total phosphorus data.

#### **NORTH STATION**

The current year data for the epilimnion (the top inset graph) show that the phosphorus concentration **decreased greatly** from **May** to **June**, and then **increased slightly** from **June** to **July**.

Please note that the **6/1/2009** phosphorus concentration was used to represent the May phosphorus concentration. Also note that there is no August phosphorus data due to a sample labeling error.

The historical data show that the **2009** mean epilimnetic phosphorus concentration is **greater than** the state and similar lake medians, and is the highest (worst) mean phosphorus concentration measured since monitoring began. Refer to Appendix D for more information about the similar lake median.

The current year data for the hypolimnion (the bottom inset graph) show that the phosphorus concentration **remained stable** from **May** to **June**, and then **increased gradually** from **June** to **August**.

Please note that the **6/1/2009** phosphorus concentration was used to represent the May phosphorus concentration.

The hypolimnetic (lower layer) turbidity sample was **elevated** on the **June, July and August** sampling events (**10.6, 22.3 and 13.0 NTUs**). This suggests that the pond bottom may have been disturbed by the anchor or by the Kemmerer Bottle while sampling and/or that the pond bottom is covered by an easily disturbed thick organic layer of sediment. When the pond bottom is disturbed, phosphorus rich sediment is released into the water column. When collecting the hypolimnion sample, make sure that there is no sediment in the Kemmerer Bottle before filling the sample bottles.

The historical data show that the **2009** mean hypolimnetic phosphorus concentration is **much greater than** the state and similar lake medians. Please refer to Appendix D for more information about the similar lake median.

Overall, visual inspection of the epilimnetic historical data trend line shows an **increasing** phosphorus trend. Specifically, the mean annual epilimnetic phosphorus concentration has **worsened** since monitoring began in **1995**.

Overall, visual inspection of the hypolimnetic historical data trend line shows a **variable** phosphorus trend since monitoring began. Specifically the mean annual concentration has **fluctuated between approximately 18 and 76 ug/L** since monitoring began in **1995**.

### **SOUTH STATION**

The current year data for the epilimnion (the top inset graph) show that the phosphorus concentration **decreased gradually** from **May** to **July**.

Please note that the **6/1/2009** phosphorus concentration was used to represent the May phosphorus concentration. Also note that there is no August phosphorus data due to a sample labeling error.

The historical data show that the **2009** mean epilimnetic phosphorus concentration is **greater than** the state and similar lake medians. Refer to Appendix D for more information about the similar lake median.

The current year data for the hypolimnion (the bottom inset graph) show that the phosphorus concentration **decreased slightly** from **May** to **June**, **remained stable** from **June** to **July**, and then **increased** from **July** to **August**.

Please note that the **6/1/2009** phosphorus concentration was used to represent the May phosphorus concentration.

The hypolimnetic (lower layer) turbidity sample was **elevated** on the **June, July and August** sampling events (**14.0, 10.3 and 17.8 NTUs**). This suggests that the pond bottom may have been disturbed by the anchor or by the Kemmerer Bottle while sampling and/or that the pond bottom is covered by an easily disturbed thick organic layer of sediment. When the pond bottom is disturbed, phosphorus rich sediment is released into the water column. When collecting the hypolimnion sample, make sure that there is no sediment in the Kemmerer Bottle before filling the sample bottles.

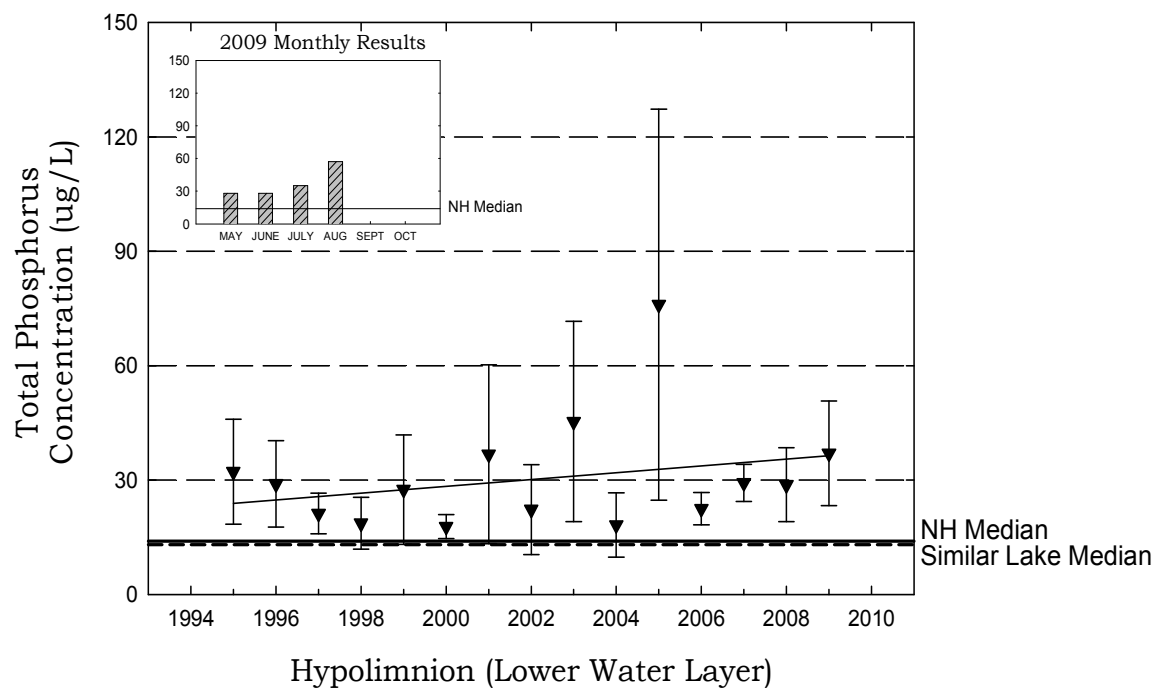
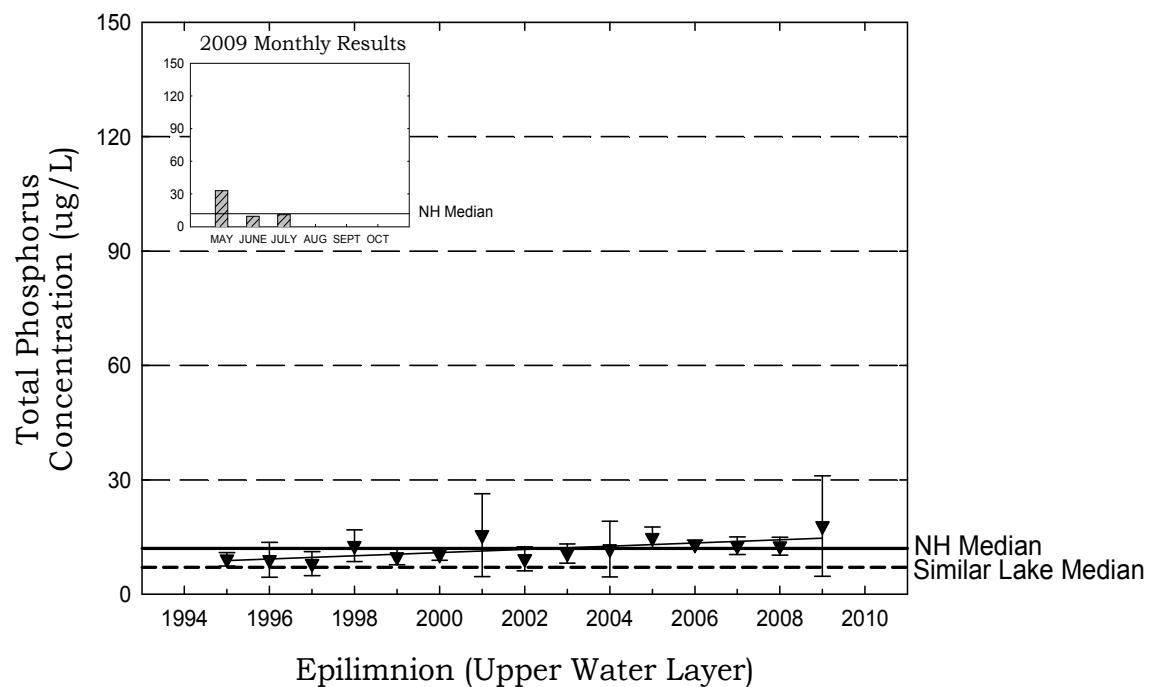
The historical data show that the **2009** mean hypolimnetic phosphorus concentration is **greater than** the state and similar lake medians. Please refer to Appendix D for more information about the similar lake median.

Overall, visual inspection of the epilimnetic and hypolimnetic historical data trend lines shows a **variable** phosphorus trend since monitoring began. Specifically the mean annual epilimnetic phosphorus concentration has **fluctuated between approximately 7 and 22 ug/L**, and the mean annual hypolimnetic phosphorus concentration has **fluctuated between approximately 15 and 31 ug/L**, since monitoring began in **1991**.

One of the most important approaches to reducing phosphorus loading to a waterbody is to continually educate watershed residents about the watershed sources of phosphorus and how excessive phosphorus loading can negatively affect the ecology and the recreational, economical, and ecological value of lakes and ponds.

## Great Pond, North Stn., Kingston

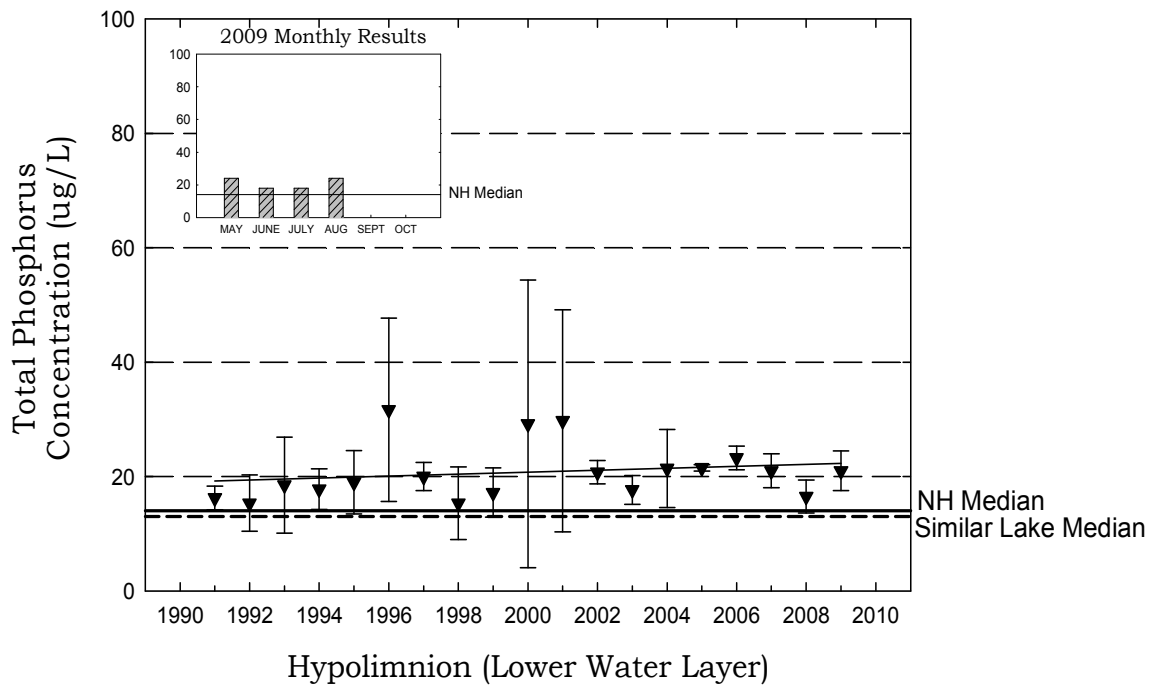
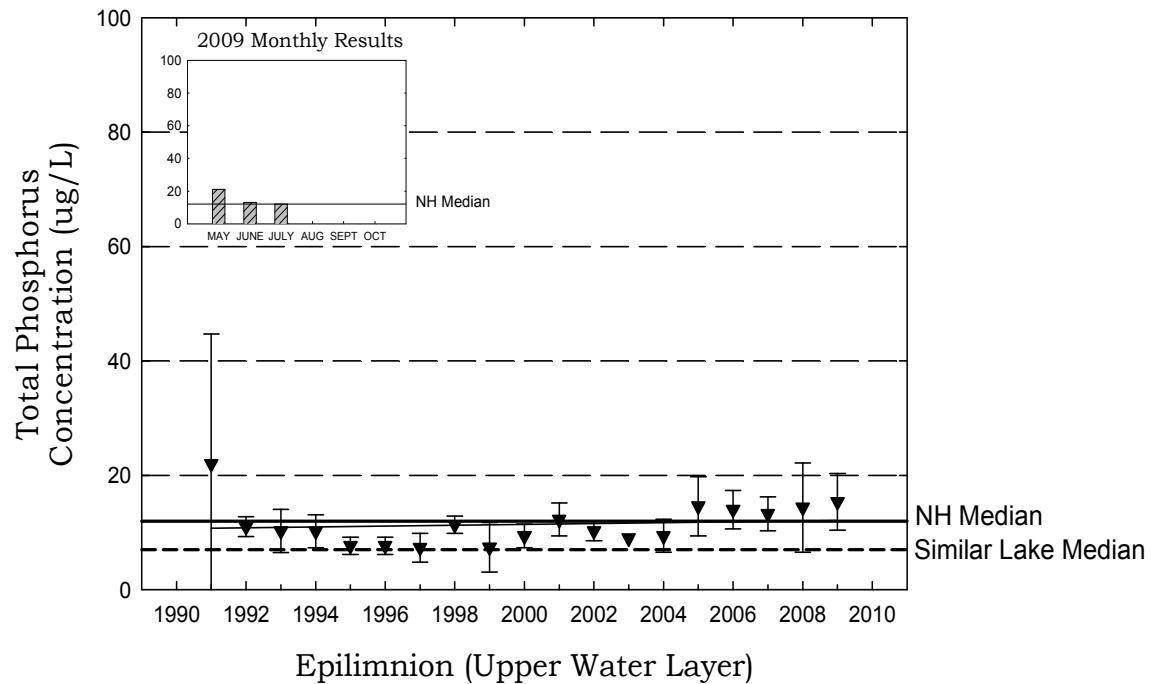
**Figure 3.** Monthly and Historical Total Phosphorus Data





## Great Pond, South Stn., Kingston

**Figure 3.** Monthly and Historical Total Phosphorus Data



## ➤ pH

Table 14 in Appendix A presents the current year pH data for the in-lake stations.

pH is measured on a logarithmic scale of 0 (acidic) to 14 (basic). pH is important to the survival and reproduction of fish and other aquatic life. A pH below 6.0 typically limits the growth and reproduction of fish. A pH between 6.0 and 7.0 is ideal for fish. The median pH value for the epilimnion (upper layer) in New Hampshire's lakes and ponds is **6.6**, which indicates that the state surface waters are slightly acidic. For a more detailed explanation regarding pH, please refer to the "Chemical Monitoring Parameters" section of this report.

The pH at the **North Station** deep spot this year ranged from **6.73 to 6.91** in the epilimnion and from **6.24 to 6.45** in the hypolimnion. The pH at the **South Station** deep spot ranged from **6.67 to 6.87** in the epilimnion and from **6.15 to 6.36** in the hypolimnion. This means that the water is ***slightly acidic***.

It is important to point out that the hypolimnetic (lower layer) pH was ***lower (more acidic)*** than in the epilimnion (upper layer). This increase in acidity near the bottom is likely due to the decomposition of organic matter and the release of acidic by-products into the water column.

Due to the state's abundance of granite bedrock and acid deposition received from snowmelt, rainfall, and atmospheric particulates, there is little that can be feasibly done to effectively increase pond pH. The pH at the deep spot, however, is sufficient to support aquatic life.

## ➤ Acid Neutralizing Capacity (ANC)

Table 14 in Appendix A presents the current year epilimnetic ANC for the deep spot.

Buffering capacity (ANC) describes the ability of a solution to resist changes in pH by neutralizing the acidic input. The median ANC value for New Hampshire's lakes and ponds is **4.9 mg/L**, which indicates that many lakes and ponds in the state are at least "moderately vulnerable" to acidic inputs. For a more detailed explanation about ANC, please refer to the "Chemical Monitoring Parameters" section of this report.

The acid neutralizing capacity (ANC) of the **North Station** epilimnion (upper layer) ranged from **10.2 mg/L to 11.4 mg/L**. The ANC of the **South Station** epilimnion ranged from **9.6 mg/L to 11.6 mg/L**. This indicates that the pond has a ***low vulnerability*** to acidic inputs.

## ➤ **Conductivity**

Table 14 in Appendix A presents the current conductivity data for in-lake stations.

Conductivity is the numerical expression of the ability of water to carry an electric current, which is determined by the number of negatively charged ions from metals, salts, and minerals in the water column. The median conductivity value for New Hampshire's lakes and ponds is **40.0 uMhos/cm**. For a more detailed explanation, please refer to the "Chemical Monitoring Parameters" section of this report.

The conductivity has **increased** in the pond since monitoring began. In addition, the in-lake conductivity is **much greater than** the state median. Typically, increasing conductivity indicates the influence of pollutant sources associated with human activities. These sources include failed or marginally functioning septic systems, agricultural runoff, and road runoff which contains road salt during the spring snow-melt. New development in the watershed can alter runoff patterns and expose new soil and bedrock areas, which could also contribute to increasing conductivity. In addition, natural sources, such as iron and manganese deposits in bedrock, can influence conductivity.

It is likely that de-icing materials applied to nearby roadways during the winter months may be influencing the conductivity in the pond. In New Hampshire, the most commonly used de-icing material is salt (sodium chloride).

*A limited amount of chloride sampling was conducted during **2009**. Please refer to the chloride discussion for more information.*

Therefore, we recommend that the **epilimnion** (upper layer) be sampled for chloride next year. This additional sampling may help us identify what areas of the watershed are contributing to the increasing in-lake conductivity.

*Please note that the DES Limnology Center in Concord is able to conduct chloride analyses, free of charge. As a reminder, it is best to conduct chloride sampling in the spring as the snow is melting and during rain events.*

## ➤ **Total Kjeldahl Nitrogen and Nitrite+Nitrate Nitrogen (only those lakes with current year Lake Survey data)**

Table 7a in Appendix A presents the current year and historical Total Kjeldahl Nitrogen and Table 7b presents the current year and historical nitrite and nitrate nitrogen. Nitrogen is another nutrient that is essential for the growth of plants and algae. Nitrogen is typically the limiting nutrient in estuaries and coastal ecosystems. However, in freshwater, nitrogen is not typically the limiting nutrient. Therefore, nitrogen is not typically sampled through VLAP. However, if phosphorus concentrations in freshwater are elevated, then

nitrogen loading may stimulate additional plant and algal growth. Please refer to the “Chemical Monitoring Parameters” section of this report for a more detailed explanation.

The ratio of the mean total nitrogen to mean total phosphorus (TN:TP) in the **South Station** epilimnion sample this year was **24**, which is **greater than 15** and indicates that **phosphorus** is the **limiting nutrient** in the pond. This means that any additional **phosphorus** loading to the pond will stimulate additional plant and algal growth. Therefore, it is not critical to conduct nitrogen sampling.

### ➤ **Dissolved Oxygen and Temperature**

Table 9 in Appendix A depicts the dissolved oxygen/temperature profile(s) collected during **2009**.

The presence of sufficient amounts of dissolved oxygen in the water column is vital to fish and amphibians and also to bottom-dwelling organisms. Please refer to the “Chemical Monitoring Parameters” section of this report for a more detailed explanation.

As previously mentioned, the turbidity and total phosphorus concentration in the **North** and **South Station** hypolimnion (lower layer) samples was **elevated** on each of the sampling events this year. Historically, the hypolimnetic dissolved oxygen concentration has been **low** on most sampling events. This suggests that the lake bottom is composed of a thick layer of organic material that is easily disturbed. The presence of a thick organic layer on the lake bottom, which is likely comprised of decomposed plants and algae, would explain the lower dissolved oxygen concentration near the lake bottom.

### ➤ **Turbidity**

Table 14 in Appendix A presents the current year data for in-lake turbidity.

Turbidity in the water is caused by suspended matter, such as clay, silt, and algae. Water clarity is strongly influenced by turbidity. Please refer to the “Other Monitoring Parameters” section of this report for a more detailed explanation.

The turbidity of the **South Station** epilimnion (upper layer) sample was **slightly elevated (2.76 NTUs)** on the **August** sampling event.

The abnormally wet conditions this summer likely led to increased stormwater runoff entering the pond. Stormwater runoff can carry particulate matter and deposits it in the pond causing turbid conditions. Or, an algal bloom had occurred in the lake.

The turbidity of the **North** and **South Station** metalimnion (middle layer) samples was ***elevated*** (**7.85 and 2.91 NTUs**) on the **August** sampling event. This suggests that a layer of algae or cyanobacteria may have been present at this location. Algae and cyanobacteria are often found in the metalimnion of ponds due to the differences in density between the epilimnion and the hypolimnion and the resulting abundance of food in that layer.

As discussed previously, the **North** and **South Station** hypolimnetic (lower layer) turbidities were ***elevated*** throughout the season. In addition, the hypolimnetic turbidity has been elevated on many sampling events during previous sampling years. This suggests that the pond bottom may have been disturbed by the anchor or by the Kemmerer Bottle while sampling and/or that the lake bottom is covered by an easily disturbed thick organic layer of sediment. When the pond bottom is disturbed, phosphorus rich sediment is released into the water column. When collecting the hypolimnion sample, make sure that there is no sediment in the Kemmerer Bottle before filling the sample bottles.

## TRIBUTARY SAMPLING

### ➤ **Total Phosphorus**

Table 14 in Appendix A presents the current year total phosphorus data for tributary stations. Please refer to the “Chemical Monitoring Parameters” section of the report for a detailed explanation of total phosphorus.

Overall, the tributaries experienced ***elevated*** phosphorus concentrations throughout the season. Record summer rainfall likely increased stormwater runoff and nutrient loading to the tributary. As impervious surface cover increases in the watershed, stormwater runoff volumes increase. This transports phosphorus-laden stormwater into tributaries and eventually the pond. Efforts should be made in the watershed to reduce impervious surfaces and limit phosphorus sources such as fertilizer use, septic influences, agricultural impacts, and sediment/erosion control.

### ➤ **pH**

Table 14 in Appendix A presents the current year pH data for the tributary stations. Please refer to the “Chemical Monitoring Parameters” section of this report for a more detailed explanation of pH.

The pH of **Kelley Brook Inlet, Outlet and Thayer Rd. Inlet** ranged from **6.31 to 6.84 (> 6)** and is sufficient to support aquatic life.

The pH of the **Ball Rd. Inlet** and **Great Pond Park Rd.** appears to be slightly acidic. This can be caused by the presence of humic, tannic and fulvic acids. Humic, tannic and fulvic acids naturally occur as a result of decomposing organic matter such as leaves. These acids may also cause the water to be tea colored. In New Hampshire the presence of granite bedrock and acid deposition also naturally lowers the pH of freshwaters.

### ➤ **Conductivity**

Table 14 in Appendix A presents the current conductivity data for the tributary stations. Please refer to the “Chemical Monitoring Parameters” section of the report for a more detailed explanation of conductivity.

The **Great Pond Park Rd., Kelley Brook Inlet, Outlet, and Thayer Rd. Inlet** experienced elevated conductivity levels this season, and have experienced elevated or fluctuating conductivity since monitoring began. We recommend that your monitoring group conduct a conductivity survey of tributaries with ***elevated*** conductivity and along the shoreline of the pond to help identify the sources of conductivity. As previously mentioned increasing conductivity typically indicates the influence of pollutant sources associated with human

activities.

*To learn how to conduct a shoreline or tributary conductivity survey, please refer to the 2004 special topic article, which is posted on the VLAP website at <http://www.des.nh.gov/organization/divisions/water/wmb/vlap/categories/publications.htm>, or contact the VLAP Coordinator.*

It is possible that de-icing materials applied to nearby roadways during the winter months may be influencing the conductivity in the tributaries. In New Hampshire, the most commonly used de-icing material is salt (sodium chloride).

Therefore, we recommend that the **tributaries** be sampled for chloride next year. This additional sampling may help us identify what areas of the watershed are contributing to the increasing in-lake conductivity.

*Please note that the DES Limnology Center in Concord is able to conduct chloride analyses, free of charge. As a reminder, it is best to conduct chloride sampling in the spring as the snow is melting and during rain events.*

The **Ball Rd. Inlet** has experienced decreasing conductivity levels since monitoring began. This is a good sign and we hope to see this decreasing conductivity continue!

### ➤ **Turbidity**

Table 14 in Appendix A presents the current year turbidity data for the tributary stations. Please refer to the “Other Monitoring Parameters” section of the report for a more detailed explanation of turbidity.

The **tributaries** experienced slightly turbid conditions on **6/29/2009, 7/27/2009 and 8/31/2009**, likely the result of stormwater runoff from significant rain events prior to sampling. Rainfall creates runoff that washes sediment and organic materials into tributaries causing turbid water conditions. Eventually, the suspended solids settle out once the flow is reduced or the tributary flow enters the lake.

The **Great Pond Park Rd. and Kelley Brook Inlet** experienced turbid conditions on **6/1/2009** likely the result of low flow conditions. These conditions can lead bottom sediment contamination during sample collection. Please be careful to observe tributary flow conditions and only sample when sufficient flow is present.

### ➤ **Bacteria (*E. coli*)**

Table 14 in Appendix A lists the current year data for bacteria (*E.coli*) testing. *E. coli* is a normal bacterium found in the large intestine of humans and other warm-blooded animals. *E.coli* is used as an indicator organism because it is easily cultured and its presence in the water, in defined amounts, indicates that

sewage **may** be present. If sewage is present in the water, potentially harmful disease-causing organisms **may** also be present. Please refer to the “Other Monitoring Parameters” section of the report for a more detailed explanation.

Two in-lake locations were sampled for *E.coli* on the DES NLA/PLA sampling events. The results were **10 counts or less** which is ***much less than*** the state standard of 406 counts per 100 mL for recreational surface waters that are not designated public beaches and 88 counts per 100 mL for surface waters that are designated public beaches.

If residents are concerned about sources of bacteria, such as failing septic systems, animal waste, or waterfowl waste, it is best to conduct *E. coli* testing when the water table is high, when beach use is heavy, or immediately after rain events.

### ➤ Chlorides

Table 14 in Appendix A lists the current year data for chloride sampling. The chloride ion (Cl-) is found naturally in some surface waters and groundwaters and in high concentrations in seawater. Research has shown that elevated chloride levels can be toxic to freshwater aquatic life. In order to protect freshwater aquatic life in New Hampshire, the state has adopted **acute and chronic** chloride criteria of **860 and 230 mg/L** respectively. The chloride content in New Hampshire lakes is naturally low, generally less than 2 mg/L in surface waters located in remote areas away from habitation. Higher values are generally associated with salted highways and, to a lesser extent, with septic inputs. Please refer to the “Chemical Monitoring Parameters” section of this report for a more detailed explanation.

The **South Station epilimnion** was sampled for chloride during the **6/24/2009** sampling event. The result was **36 mg/L**, which is ***less than*** the state acute and chronic chloride criteria. However, this concentration is ***greater than*** what we would normally expect to measure in undisturbed New Hampshire surface waters.

We recommend that your monitoring group continue to conduct chloride sampling in the epilimnion at the deep spot, particularly in the spring during snow-melt and during rain events during the summer. This will establish a baseline of data that will assist your monitoring group and DES to determine lake quality trends in the future.

*Please note that chloride analyses can be run free of charge at the DES Limnology Center. Please contact the VLAP Coordinator if you are interested in chloride monitoring.*



## DATA QUALITY ASSURANCE AND CONTROL

### Annual Assessment Audit

During the annual visit to your pond, the biologist conducted a sampling procedures assessment audit for your monitoring group. Specifically, the biologist observed the performance of your monitoring group while sampling and filled-out an assessment audit sheet to document the volunteer monitors' ability to follow the proper field sampling procedures, as outlined in the VLAP Monitor's Field Manual. This assessment is used to identify any aspects of sample collection in which volunteer monitors failed to follow proper procedures, and also provides an opportunity for the biologist to retrain the volunteer monitors as necessary. This will ultimately ensure that the samples volunteer monitors collect are truly representative of actual lake and tributary conditions.

Overall, your monitoring group did an **excellent** job collecting samples on the annual biologist visit this year! Specifically, the members of your monitoring group followed the proper field sampling procedures and there was no need for the biologist to provide additional training. Keep up the good work!

### Sample Receipt Checklist

Each time your monitoring group dropped off samples at the laboratory this summer, the laboratory staff completed a sample receipt checklist to assess and document if your group followed proper sampling techniques when collecting the samples. The purpose of the sample receipt checklist is to minimize, and hopefully eliminate, improper sampling techniques.

Overall, the sample receipt checklist showed that your monitoring group did a **very good** job when collecting samples this year! Specifically, the members of your monitoring group followed the majority of the proper field sampling procedures when collecting and submitting samples to the laboratory. However, the laboratory did identify a few aspects of sample collection that your group could improve upon, as follows:

- **Sample labels:** On the **8/31/2009** sampling event, at least one sample bottle was not mis-labeled. It was not possible for the laboratory staff to determine which sample bottles corresponded to what sampling locations. Please label your samples with a waterproof pen preferably by using a black permanent marker before sampling. If your association has made its own sample bottle labels, please fold over one corner of each label before placing it on a sample bottle so that the label will not become permanently attached to the bottle. In addition, please make sure that the labels will stick to the bottles when they are wet.

**USEFUL RESOURCES**

*Best Management Practices to Control Nonpoint Source Pollution: A Guide for Citizens and Town Officials*, DES Booklet WD-03-42, (603) 271-2975 or [www.des.nh.gov/organization/commissioner/pip/publications/wd/documents/wd-03-42.pdf](http://www.des.nh.gov/organization/commissioner/pip/publications/wd/documents/wd-03-42.pdf).

*Cyanobacteria in New Hampshire Waters Potential Dangers of Blue-Green Algae Blooms*, DES fact sheet WMB-10, (603) 271-2975 or [www.des.nh.gov/organization/commissioner/pip/factsheets/wmb/documents/wmb-10.pdf](http://www.des.nh.gov/organization/commissioner/pip/factsheets/wmb/documents/wmb-10.pdf).

*Erosion Control for Construction in the Protected Shoreland Buffer Zone*, DES fact sheet WD-SP-1, (603) 271-2975 or <http://des.nh.gov/organization/commissioner/pip/factsheets/sp/documents/sp-1.pdf>

*NH Stormwater Management Manual Volume 1: Stormwater and Antidegradation*, DES fact sheet WD-08-20A, (603) 271-2975 or <http://des.nh.gov/organization/commissioner/pip/publications/wd/documents/wd-08-20a.pdf>

*NH Stormwater Management Manual Volume 2: Post-Construction Best Management Practices Selection and Design*, DES fact sheet WD-08-20B, (603) 271-2975 or <http://des.nh.gov/organization/commissioner/pip/publications/wd/documents/wd-08-20b.pdf>

*NH Stormwater Management Manual Volume 3: Erosion and Sediment Controls During Construction*, DES fact sheet WD-08-20C, (603) 271-2975 or <http://des.nh.gov/organization/commissioner/pip/publications/wd/documents/wd-08-20c.pdf>

*Proper Lawn Care In the Protected Shoreland, The Comprehensive Shoreland Protection Act*, DES fact sheet WD-SP-2, (603) 271-2975 or <http://des.nh.gov/organization/commissioner/pip/factsheets/sp/documents/sp-2.pdf>.

*Road Salt and Water Quality*, DES fact sheet WD-WMB-4, (603) 271-2975 or [www.des.nh.gov/organization/commissioner/pip/factsheets/wmb/documents/wmb-4.pdf](http://www.des.nh.gov/organization/commissioner/pip/factsheets/wmb/documents/wmb-4.pdf).

*Through the Looking Glass: A Field Guide to Aquatic Plants*, North American Lake Management Society, 1988, (608) 233-2836 or [www.nalms.org](http://www.nalms.org).

*Vegetation Maintenance Within the Protected Shoreland*, DES fact sheet WD-SP-5, (603) 271-2975 or <http://des.nh.gov/organization/commissioner/pip/factsheets/sp/documents/sp-5.pdf>